UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY,
WASHINGTON, D. C.

FOREST ENTOMOLOGY.

INSECT DAMAGE AND PROPOSED CONTROL MEASURES IN THE SEQUOIA AND GENERAL GRANT NATIONAL PARKS - SURVEY OF 1917.

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UNITED STATES DEPARTMENT OF AGRICULTURE,

Bureau of Entomology,

Washington, D.C.

Pacific Slope Station, Dec. 6, 1917.

Summary of Report and Recommendations to

Dr. A. D. Hopkins.

The only important timber loss caused by insects in the Sequoia Park is confined to yellow pine and sugar pine species and can be divided into 6 distinct areas or units of infestation conforming to the drainage basins of tributaries of the Kaweah River.

Infestation throughout the Park is epidemic in character and is at present increasing. The loss during the seasons of 1916 and 1917 is estimated at 6,015,000 feet board measure and includes many of the largest, mature pine trees. Approximately 55% of this loss occurs in the basins of the Middle Fork and Marble Fork of the Kaweah River.

A project to carry out the control of the infestation throughout the entire Park during the season of 1918 is not considered practical for administrative reasons. The cost of a one year project of this extent would vary from $7,500 to $12,500.

It is considered that control work can be efficiently carried out on two of the six infestation units. On account of the protective values involved and the epidemic status of the infestation, the Middle Fork of the Kaweah (Unit 10) and the Marble Fork of the Kaweah (Unit 11) are recommended as separate insect control projects for the season of 1918.

The total cost of both projects is estimated at $3600.00 to $5800.00. Twenty-five per cent of the cost of control work on Unit 10, ($600 to $975)

will be on lands of the Sequoia National Forest. The cost of control work upon lands of the Sequoia National Park on both projects will vary from $3000.00 to $4850.00.

A minimum appropriation of $3000.00 by the Department of the Interior is recommended for control work during 1918 in Units 10 and 11. Unit 10 should be considered first in the expenditure of this appropriation, the balance to be expended upon Unit 11. Under favorable conditions it will be possible to complete both projects in 1918.

Unit 10 affords the most favorable conditions that have been found for an intensive study of the application and results of the percentage principle of control. The approval of the Department of the Interior is desired for the selection of this area for intensive studies by the Bureau of Entomology and the Forest Service. The expense of these studies, which will be conducted just preceding and subsequent to control according to the Ashland conference plan of January 1917, will be paid by the Department of Agriculture.

In order to bring the management of the project under one head it is proposed that the Bureau of Entomology assume the technical supervision of the control work and arrange the essential cooperation with the Forest Service.

Specific Recommendations.

1. That insect control be undertaken in the Middle Fork of the Kaweah (Unit 10) and Marble Fork of the Kaweah (Unit 11) during the season of 1918.

2. That the Department of the Interior appropriate a minimum fund of $3000.00 to cover the cost of control work on these two areas in the Sequoia National Park.

3. That the Forest Service appropriate a minimum fund of $600.00 to cover the cost of control work on National Forest lands in Unit 10.

4. That control work be started first on Unit 10 and carried through to completion, the balance of the fund then to be applied to control work on Unit 11.

5. That the approval of the Interior Department be requested for the study of Unit 10 as a special investigative project by the Bureau of Entomology and the Forest Service.

6. That the technical supervision of the work on the National Park be assumed by the Bureau of Entomology and that the same organization arrange the necessary cooperation with the Forest Service.

Assistant Forest Entomologist.

MEMORANDUM FOR DR. A. D. HOPKINS.

Results of the 1917 insect survey of the Sequoia National Park with estimates and recommendations for proposed control work.

Character of the Examination.

The Sequoia National Park was examined in accordance with the schedule for the regular field work of the 1917 insect survey of pine timber of California. The examination of the infested areas was conducted during the period from July 15 to August 2, and included both the General Grant and Sequoia National Parks. An appropriation of $75.00 was made by the Department of the Interior to cover the field expense of this survey and $72.50 of this amount was expended. It is suggested that a copy of the general report of the California survey be forwarded to the Supervisor of the Sequoia National Park in order to obviate the necessity of explaining in detail in this report the character of the examination.

At the request of Mr. Frye a preliminary memorandum was submitted to him giving approximate estimates of loss and the cost of control work, in order that the consideration of the allotments for this work could be taken up in time for the spring work. This preliminary memorandum, a copy of which was forwarded to your office, was submitted on August 25 with the understanding that the estimates given would be subject to revision after the complete data had been worked up.

General Conditions Which Affect Insect Infestation.

The infestation that was found to exist on the Sequoia National Park can be divided into well defined areas or units of infestation. This is

due to the peculiar distribution of forest types, and the topographic features which exist in the watersheds of the Kaweah River. Briefly the timbered areas of this Park consist of a fairly distinct belt extending from north to south throughout the entire length of the Park along the western flank of the Great Western Divide of the Sierra Nevada Mountains. From west to east this belt is comparatively narrow and extends from the lower to the upper timber lines or approximately between the elevations of 4000 and 11000 feet. This timbered belt can be divided into six distinct drainage basins formed by the tributaries of the Kaweah River which in general flow toward the west and find their way into the San Joaquin Valley. High dividing ridges with a distinct break in type still further separate the timbered areas of several of these drainage basins. The infestation is still further limited by the pronounced divisions in forest types which to a great extent follow the contour lines of elevation within the drainage basins. These can be separated roughly into three general types as follows:

1. The yellow pine and sugar pine type predominates between the elevations of 4000 and 7500 feet.

2. The fir type in which species of Abies predominate begins at about 7500 and extends up to 10,000 feet. This type includes nearly all of the Sequoia groves and extensive areas of lodgepole pine above 8000 feet.

3. From 10,000 feet to the upper timber line the forest consists of what is known as the alpine and subalpine type.

The infestation within this park was found entirely within the yellow pine and sugar pine type.

There is no infestation of any consequence in the fir type. It is not considered that the infestation which may at any time develope in the fir species will ever be of a character which will warrant control measures.

The Sequoia groves always have been and so far as we are able now to determine always will be free of any insect enemies which will kill the healthy trees. The lodgepole pine forests may at any time develope serious insect epidemics but no infestation of an epidemic character was found in any of the lodgepole stands examined on this survey.

Some insect loss may develope in the alpine and subalpine forests, but it is not considered that this will ever be serious or that insect control will ever be practical or feasible under such conditions as those found near the upper timber line.

The insect control problem in the Sequoia National Park therefore, involves only the yellow pine-sugar pine type. On the General Grant Park the situation is quite different on account of its small area and location. As on the Sequoia the infestation is limited to the yellow pine and sugar pine, but it involves only a very few infested trees and cannot be grouped into infestation units.

Character and Amount of Loss.

As the California survey included practically all of the infested areas of the Sequoia Park the infestation in this report is considered and discussed according to the infestation units outlined and established in the general report of the survey. These units are named and numbered and their location shown on the map which accompanies this report. The summaries of the data secured for each unit are given on the unit forms of the regular survey which accompany this report. The data pertaining to the General Grant Park is given on the same form but not as a separate infestation unit.

The estimates which were compiled by the District Forester in San Francisco show that the loss during the seasons of 1916 and 1917, consisted of 1080 yellow pine trees amounting to 2,679,000 feet board measure, and 548 sugar pine trees, amounting to 3,336,000 board feet. Totaling these it

is apparent that insects during two years have caused a total loss of mature timber amounting to 1628 trees or 6,015,000 feet board measure. The loss for the season of 1917 alone is estimated about three-tenths of one per cent of the total stand of pine timber.

The loss on the General Grant National Park is estimated at 4 yellow pine amounting to 9,400 feet and 4 sugar pine amounting to 16,000 feet, a total of 25,400 board feet.

Primary Infesting Insects Responsible for Loss.

Practically all of the loss recorded can be attributed to three species of Dendroctonus beetles. These are:

The Western Pine Beetle (Dendroctonus brevicomis Lec.)
This species is killing the yellow pine and with a few exceptions practically all of the dead yellow pine examined were killed by this species.

The Mountain Pine Beetle (Dendroctonus monticolae, Hopk.)
This species is primarily responsible for the loss of the sugar pine. It also occurs in yellow pine but not to an extent to cause any appreciable damage.

The Jeffrey Pine Beetle (Dendroctonus jeffreyi Hopk.)
is responsible for the killing of Jeffrey pine, the loss of which is included with yellow pine. The amount of loss in this species however is small.

Significance of Present Loss.

The commercial value of the pine timber which is being killed on a National Park will vary probably not be considered the primary basis for an insect control policy. While the commercial value of the timber is not to be disregarded, it is the esthetic value which is first considered and the protection of those trees is especially desirable, which by their size, age, beauty or sentimental interest add to the attractiveness of the National Park.

From this standpoint the insect control problem on the Sequoia National Park is of considerable importance. The insects are killing the largest

and oldest yellow pine and sugar pine trees. Sugar pine especially is suffering from the loss of some of the finest forest veterans in the Park. Trees which are three and four hundred years old may be killed in one or two years by the beetles. The same is true of the yellow pine. The rate of loss is slow, not as yet, exceeding more than 1% of the stand, and the trees which are lost will in time be replaced by the new growth which is coming on, but it will require several centuries to complete the cycle and thus replace the old trees which are now being killed. In view of this, control of the infestation may be desirable even at considerable expense, regardless of the actual stumpage value of the timber which would amount to $13,500.00 during the period covered by the survey, assuming an average value of $2.25 per M.B.M.

General Estimates of Cost.

Throughout the Park the infestation is rated as epidemic and increasing, and the values involved are such that control work can be considered to advantage in any of the proposed units of infestation.

The earliest date at which control work can now be started will be in the spring of 1918. The exact amount of infested timber which will exist at that time cannot be estimated definitely as it will depend to a great extent upon the fluctuation of the infestation during the season of 1917. Assuming, however, that the average annual loss is 3,007,500 or one-half of that recorded for the two years, and that, allowing for first seasonal generation trees, the infested timber in the spring of 1918 will vary 25% one way or the other from this average annual loss, it is estimated that the amount of timber which can be treated will vary between a minimum of 2,250,000 B.M. and a maximum of 3,700,000 B.M. Still further assuming that 75% of the infested timber can be treated at a cost of $4.00 per M.B.M.

the cost of control in one season for the entire Sequoia National Park will vary in approximate figures between a minimum of $7500 and a maximum of $12,500.

However, a general project to treat the entire infestation of the Park in one season does not appear to be practical for administrative reasons. The period of time in which the work would have to be completed would not extend over eight or ten weeks and it is evident that a far larger force of trained woodsmen would have to be employed than is apparently available. It would still further be impractical to give a project of this extent the necessary technical supervision.

On the other hand the work can be carried out efficiently in one season on one or two of the infestation units and because of the definite barriers which constitute the boundaries of practically all units in the Park the protection which would result from this work would be effective, and the expenditure would therefore be justified. The recommendations in this report for 1918 control work will therefore be limited to two of the proposed infestation units.

The basins of the Middle Fork of the Kaweah River (Unit 10) and the Marble Fork of the Kaweah (Unit 11) are both accessible from the Giant Forest and probably cover that section of the Park which comes under the observation of the greatest number of visitors. Therefore protective values are high. It is also within these two units that 55% of the total loss for the entire Park was recorded and the infestation appears to be of the most serious epidemic character. The estimates for control work are therefore limited to these two units for the season of 1918 and estimates for control of the remaining units of the Park will be considered at the close of next season.

Estimates for Units 10 and 11

MIDDLE FORK OF THE KAWEAH (UNIT 10)

Yellow pine

			Minimum	Maximum
No. of infested trees (estimated) season of 1918			180	300
Board Measure of infested trees	" "	M.B.M.	423	705

Sugar pine

No. of infested trees.	" "		60	100
Board Measure infested	" "	M.B.M.	360	600

Totals both species

No. of infested trees	" "		240	400
Board Measure infested	" "	M.B.M.	783	1305
Cost of control, 75% at $4.00 per M.			$2400	$3900

Approximately 25% of the infestation is on Forest Service Land.

The expense as apportioned to each ownership would stand as follows:

	Minimum	Maximum
Forest Service	$ 600	$ 975
Sequoia National Park	1800	2925

MARBLE FORK OF KAWEAH (UNIT 11)

Yellow pine

			Minimum	Maximum
Nol infested trees (estimated) Season of 1918			83	137
Board Measure infested "	" "	M.B.M.	195	322

Sugar pine

No. infested trees (estimated) Season of 1918			33	55
Board Measure infested "	" "	M.B.M.	198	330

Totals of both species

No. infested trees			116	192
Board measure infested		M.B.M.	393	652
Cost of control, 75% at $4.00 per M.B.M.			$1200	$1950

This Unit is entirely within the jurisdiction of the Sequoia National Park so that the entire cost of control should be assessed to the Department of the Interior.

Estimated Cost to Sequoia National Park

for both projects - 1918.

	Minimum	Maximum
Middle Fork of the Kaweah (Unit 10)	$1800.00	$2925.00
Marble Fork of the Kaweah (Unit 11)	$1200.00	1950.00
Totals	$3000.00	$4875.00

The cost to the National Park for the control of the infestation on these two projects may vary from $3000.00 to $4875.00 These estimates are somewhat higher than usual because of the cost of supplies, labor, etc. under present conditions. Favorable conditions may bring the cost of the work somewhat under the minimum but it is not believed that the cost will exceed the maximum given for either project.

Unit 10 should be considered first in control plans because of its earlier accessibility and the necessary cooperation with the Forest Service should be arranged if the recommendations of this report are adopted.

An appropriation of $3000 for insect control will insure completing the work on Unit 10 even though the cost reaches a maximum figure. If, however it is possible to complete the work on this unit at the minimum estimate there will be left an available balance of $1200 to expend on Unit 11. Under favorable conditions it would be possible to complete both projects in the one season.

Unit 10 Suitable for Intensive Studies.

The isolation and effective barriers of Unit 10 afford the best situation that has been found in the state for an intensive study of the application of and results of control work in Dendroctonus brevicomis infestation. For this reason the project will be a very suitable one for Area A under the Ashland conference plan for investigative projects. The

approval of the Department of the Interior is desired if the area is accepted for this purpose. Such a purpose will not involve any experimentation in methods or deviation from established methods approved by the Bureau of Entomology. It will involve only an intensive study of the area before the percentage principle of control is applied and subsequent annual examinations to study the results of this application. The expense of these intensive investigations will be carried by the Forest Service and the Bureau of Entomology, the Department of the Interior paying only for the actual application of regular control methods on the National Park lands.

Under this plan the Forest Service and the Department of the Interior will each pay their proportional share of the cost of control, but the entire project should come under one management. In order to effect this it is proposed that the Bureau of Entomology undertake the technical supervision of the work for the National Park, and also arrange the necessary cooperation with the Forest Service according to the Outline of the Ashland conference plan.

Such a project will also afford an opportunity for the training of men in the National Park Service in Insect Control Methods.

J. M. Miller

Assistant Forest Entomologist.

U. S GEOLOGICAL SURVEY
GEORGE OTIS SMITH
DIRECTOR

DEPARTMENT OF THE INTERIOR
ADMINISTRATIVE MAP

CALIFORNIA
SEQUOIA AND GENERAL
NATIONAL PARKS

SIERRA NATIONAL FOREST

SEQUOIA NATIONAL FOREST

LEGEND

Insect Control Units
Sequoia National Park
Survey of Aug 1917
Units

⑦ South Fork Kaweah River.
⑧ East Fork Kaweah River.
⑨ Salt Creek.
⑩ Middle Fork Kaweah River.
⑪ Marble Fork Kaweah River.
⑫ Cactus Creek.
⑬ Stony Creek.

TREES SPOTTED IN EXTENSIVE RECONNAISSANCE

• 1916 and 1917 Insect Killed Yellow pine.
+ 1916 and 1917 Insect Killed Sugar pine.

R. U. Goode and E. M. Douglas, Geographers.
E C. Barnard and R. B. Marshall, Topographers in charge.
Topography by E. C. Barnard, R. B. Marshall, A. I. Oliver.
Geo. R. Davis, R. B. Oliver, and W. C. Guerin.
Triangulation by E. T. Perkins,
Surveyed in 1902–1903

SURVEYED IN COOPERATION WITH THE STATE OF CALIFORNIA.

APPROXIMATE MEAN DECLINATION 1902

Scale 1:125000
1 ½ 0 1 2 3 4 5 Miles
1 ½ 0 1 2 3 4 5 Kilometers
Contour interval 100 feet.
Datum is mean sea level

Edition of Mar 1910